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REPORT

ON THE

EXPLOSIONS WHICH OCCURRED

AT

Benwell Colliery on the 19th March, 1907;

and

Whitehaven Colliery on the 26th November, 1907.

EDITED BY

R. A. S. REDMAYNE,

H.M. CHIEF INSPECTOR OF MINES.

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SIR,

From exhaustive written particulars supplied by Mr. J. B. Atkinson, relative to two Colliery Explosions which occurred in his District last year, incidentally mentioned in his Annual Report, viz.: the Benwell Colliery Explosion which happened on Tuesday, 19th March, 1907; and the Whitehaven Colliery Explosion which occurred on Tuesday, the 26th November, 1907, I have taken what seems to me to be of importance, and in this edited form have the honour to submit the reports as follows :—

THE BENWELL COLLIERY EXPLOSION.

This explosion occurred at 5.40 p.m. in the Brockwell seam of the Charlotte pit, situated in the City of Newcastle-upon-Tyne, and owned by Messrs. Cochrane Carr, Ltd., and caused the death of four persons.

At the adjourned inquest held on the 4th of April at the Central Police Court, Newcastle-upon-Tyne, eight witnesses were examined, including Mr. E. T. Ornsby, the manager of the colliery, Mr. Abbott, and Mr. J. B. Atkinson, who gave expert evidence of the explosion, and Dr. G. H. V. Appleby, who gave medical evidence as to cause of deaths.

The jury returned the following verdict with reference to Archibald Robson: "That deceased died from carbon monoxide poisoning produced or "resulting from an explosion of fire damp and coal dust in that part of the "North Flat Fenham District of the Brockwell seam, Benwell Colliery, where "he was working when he met his death, which said fire damp and coal dust "were ignited by the light from a safety lamp taken by deceased from the "caution board in the said district and used by him for the purposes of his "work. The deceased on substituting the red glass of the lamp for a white "glass, having inadvertently caused the gauze inside the lamp to slip or "otherwise become detached from the said lamp and fall to the ground thus "causing the light therein to become a naked one, and igniting the said fire-"damp and coal dust, and the jury are of opinion there has been no negligence "on the part of the management of the colliery."

Similar verdicts with respect to the other victims of the explosion were afterwards returned.

The only seam being worked in the colliery at the time of the accident was the Brockwell which at the downcast (and coal drawing) shaft is 252 yards from the surface and lies nearly level. The daily output from the pit was 430 tons. The seam, which is worked on the bord and pillar system, is moderately gaseous, and though locked safety lamps were used in the workings

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both in the formation and extraction of the pillars, the use of naked lights was permitted on the intake air roads up to the caution boards, the positions of which are marked on the plan.

Single gauze shielded Clanny safety lamps with red glasses were hung at the boards during the time the hewers were in the pit.

The safety lamps used by the hewers were the Protector type with double gauzes, the deputies, drivers, putters, etc., having the Donals lamp.

The explosion was confined to two adjoining districts known as the Fenham North and Fenham West (*see* Plan 1). It was given in evidence at the inquest that the deputies had not reported gas in these two districts that year, although the manager had about six weeks prior to the explosion detected it on venturing some distance into the goaf.

About the time of the explosion there was little variation in the atmospheric pressure.

The air current ventilating the districts amounted to 12,000 cubic feet per minute, and was circulated by a Capell fan exhausting from the top of the upcast shaft, which, at the time of the explosion, was running at its usual speed. The direction of the air current was as follows :—On leaving the endless rope haulage road it passed to the junction where it divided, one portion going to the face of the Fenham North and passing round the goaf edge returned to the air crossing over the horse road leading to the Fenham West district. The remainder passed under the air crossing, went up the first working headways where it split, one portion passing eastward, and over the air crossing, the remainder westward round the goaf edge and so out-bye to the main return where it joined the air coming over the air-crossing.

The coal of this seam is at Benwell of a friable nature, and a moderate amount of coal dust is produced in the working of it and in its transportation where there is sufficient dryness. The presence of coked dust on the timber, etc., over practically the whole area traversed by the explosion, the blackening of surfaces, and of the bodies of the victims, and the general appearance of the districts showed that coal dust was present in some quantity before the explosion.

No explosives were used for getting the coal in the extraction of the pillars and rarely when taking up the bottom stone, which work was mostly done with picks, and there was no evidence that any shot had been fired at the moment of the explosion.

On the day of the explosion the districts had been examined by the two fore shift deputies in the usual way both before the entry of the hewers and during the course of the shift, and they reported all the working places free from gas ; and between 12 and 1 p.m., the back overman had been round the districts and also found them free from gas.

When the explosion occurred there were about 30 persons underground, none of whom, except the deceased, suffered any injury. There were but four persons in the Fenham North and West districts, namely the deceased, the others having ceased work at about 4.30 p.m. Some men working at the endless rope road, about 300 yards in-bye from the horse road into the district, felt a rapid movement of the air, and coming out of the shaft raised the alarm. The manager, under-manager, and other officials were summoned and exploration made, and little difficulty being experienced from after-damp the Fenham North district was quickly reached, and the bodies of Robson and Johnson discovered. Robson was found on the main road about 25 yards from the entrance of a "jud."

It should be mentioned that Robson and Kirk were back-shift deputies and had remained after their ordinary shift to draw timber from three completed "juds," one in the Fenham North, and two, opposite each other, in the Fenham West district, and two lads (Johnson and Conelly) remained with them to assist

them in removing the drawn timber and rails. Robson was lying on his face with his head out-bye, and was severely burned and blackened with dust ; 6 yards in-bye from his body a locked extinguished safety lamp was found lying on its side.

Johnson's (one of the lads) body was lying beside a tram partly loaded with timber and rails at the entrance to the "jud," on his back with head out-bye and badly burned. On the day after the explosion a locked safety lamp (No. 105) was found by Mr. Abbott lying on its side near to where Johnson's body had been. Another safety lamp was also found by Mr. Abbott standing on its bottom on the floor about half way up the "jud."

Owing to difficulties due to the presence of fire-damp the bodies of Kirk and Conelly (the other lad), were not discovered until 4 a.m. on the 20th. Both were in the left hand "jud." Kirk was lying under a timber train and Conelly was a few yards nearer the face of the "jud." Three safety lamps were found here, one of which, a shielded Clanny, had the glass broken and the lamp otherwise damaged.

Dr. Appleby's report shows that death was not due to violence, but (in all the cases) to poisoning from inhalation of carbon-monoxide gas.

The area over which the explosion had extended could be traced by the presence of the coked dust on the props, crowns, tubs, etc., and on the sides opposite to the direction of the blast—if the point of origin of the explosion is correct.

There was little evidence of violent explosive force, none of the timber supporting the roof had been displaced, the brick stopping furthest in on the right of the road into the Fenham North district was blown out from the intake, the air-crossing was lifted from the intake, coal dust had been blown into the returns for a few yards on each side of it. The canvas sheets and doors were nearly all displaced. Wooden tubs were not broken, nor three tool chests used by the deputies and shifters.

As to the starting point of the explosion it would appear to have been lamp No. 105, for the following reasons :—

There was, so far as is known, no source of ignition other than the flame of a safety lamp.

All the lamps were locked when found, and there was no evidence that damage to the lamp in Kirk's "jud" was caused before the explosion, but was rather the effect of it.

All the lamps when unlocked were found to contain all their parts except No. 105, which, when unlocked, was found to be without a gauze, and George Mitchell, a shifter, had, prior to the unlocking of it, found a gauze lying near the deputies' chest in Fenham North, which fitted the lamp, and no doubt formed part of it.

It is usual, when drawing timber, for the deputy to take with him a lighted spare lamp in case his ordinary lamp is extinguished, and it appeared that the red lamp hung at the caution board was sometimes used for this purpose, Robson keeping a clear glass in his chest to replace the red one, and it would seem that in the process of replacement on this occasion that the gauze had accidentally dropped out and not been noticed, and the lamp taken gauzeless to the face. The red glass was found in Robson's chest after the explosion.

The fact that the gauzeless lamp had been taken in-bye and been in use sometime before the explosion shows that up to the moment of the explosion it had not come into contact with an inflammable mixture.

There was no indication that flame or force had travelled along the goaf edge to the other "juds" where Kirk and Conelly were engaged, nor had it passed down the returns leading to the air-crossing, by which route gas coming from the goaf where Robson was working would be carried away, on the other hand the crust of coke showed that flame had extended against the air current from the point of origin for 330 yards on the intake and horse road, and that when it arrived at the junction to Fenham West it had passed in-bye under the

air-crossing and up the headways, at the inner end of which Kirk and Conelly were working, and had also continued farther in and around some of the workings there, but had not extended out-bye to the return air-way. In fact it seemed clear that the flame of the initial gas explosion had been carried by coal dust by the somewhat circuitous route described, and had not come by the directer route along the goaf edge.

The explosion began practically in what had been the main horse haulage road into the Fenham North district, where there would consequently be more coal dust than usual.

The greatest manifestations of explosive force were in the direction of the fresh air where fire damp was least likely to be present, but where there was most coal dust due to the leading of the coal.

For some days after the explosion gas was present in the "juds" where Robson and Kirk had been engaged, and extended from there for about a pillar in the direction of the return air way, although the ventilation was as usual and the barometer then began to rise a few hours after the explosion, and remained comparatively steady for several days, and there was no evidence of any unusual fall of roof having taken place in the gaof.

The workmen of the Colliery had under General Rule 38 examined the workings of the Colliery on the 11th and 12th January and their report was favourable.

WHITEHAVEN COLLIERY EXPLOSION (CUMBERLAND).

This explosion, one of fire damp and air, occurred about 1.50 p.m. on Tuesday, the 26th of November, in a stone drift known as No. 6, or Taffy's Drift, which was being driven from the intake air-way and endless rope haulage road leading to the Lowca and Countess districts of the undersea workings in the Main band or seam of the William Pit. The shafts of the Whitehaven Colliery are situated in the town of Whitehaven, and the Colliery is being worked by the Whitehaven Colliery Co.

Five men were killed and seven injured by the explosion.

The inquest was held on 27th and 28th of November, and 3rd December, 1907, and 7th January, 1908. The witnesses included four of the injured workmen, the three deputies who inspected the drift, the two surviving shot-firers, the overman, under-manager, assistant general-manager and manager of the Colliery, two of the workmen who inspected the mine under General Rule 38, Mr. R. W. Williams (the contractor for driving the drift); Mr. R. W. Moore (Lord Lonsdale's Mineral Agent); and Mr. J. B. Atkinson (H.M. Inspector of Mines for the District). The verdict of the jury was as follows :—"The "jury are of the opinion that the five men lost their lives in No. 6 Drift, "William Pit, by an explosion of gas, but how it occurred there is not sufficient "evidence to show. But they are also of the opinion that there was not "sufficient ventilation."

623 persons were employed underground in the William Pit. 369 hewers in three nearly equal shifts, the hours from bank to bank being as follows :—

Morning shift	...	6 a.m. to 3 p.m.;
Afternoon shift	...	2 p.m. to 11 p.m.;
Night shift...	...	10 p.m. to 7 a.m.

The remaining persons employed underground—consisting of trailers (putters), haulage men, joiners (timberers), drifters (stonemen) and officials—were spread over the various shafts.

The only seam at present being worked at the William Pit is the Main Band, a thick seam of which 9 feet is worked giving a daily output of 800 tons of coal.

The downcast (drawing) shaft is 12 feet in diameter and 200 yards deep to the Main Band; near it is the upcast shaft 13 feet in diameter, of the same depth to the Main Band as the downcast, and it is surmounted by a Walker's Indestructible Fan which exhausts from the Mine 115,000 cubic feet of air per minute. But both the shafts are sunk 76 yards further down to the Six-quarters Band. The seams dip westward or seaward, but as will be seen from Plate IV. this dip is counteracted by several upthrow faults, so that the depth from the sea bottom at the point where the explosion originated is approximately 202 yards, the depth of the sea at high water being 80 feet.

The system of haulage is endless rope running below the tubs, self-acting inclines with hand-trailing or putting—no horses or ponies being employed.

The endless rope travels at a speed of about 3 miles per hour, and sets of 20 tubs with a clutch bogie at each end run at intervals. The workmen ride both in-bye and out-bye over certain lengths of the rope road.

One rope 13,500 yards long extends as an endless rope from the shafts into the Countess District. The haulage of the Delaval and Lowca Districts is performed by compressed air engines situated at a point called the friction gear and marked on Plate V.

Except near the downcast shaft where there are acetylene gas lights, no lights other than locked safety lamps of the Marsaut type are used, the latter burning paraffin oil, and being magnetically unlocked and fitted for electric lighting. Twelve electric re-lighters were placed at different points in the workings, one being placed at the foot of No. 6 drift.

No explosives were used in getting the coal, but in driving the Stone Drifts Saxonite, a "Permitted Explosive," fired by No. 6 Detonators and electric battery was employed.

The plan on Plate IV. shows such of the general features of the Colliery as are necessary for the purposes of this report. Plate V. gives in plan and section the position of No. 6 drift and the workings antiguous thereto, and Plate VI., in large scale, the immediate locality of the explosion.

In order to replace a section of haulage and intake air road which included a right-angled turn and which also, at several parts, was small in sectional area and of varying gradient—namely that portion represented by the letters A, B, C, D, on the plans on Plates IV. and V.—it was decided, some years ago, to make a new straight road of ample sectional area and of uniform gradient.

This road which was started from the out-bye end and known as No. 5 drift was driven with a dipping gradient of 1 in 17 for 900 yards. Some water was met with and operations were suspended in June, 1904, and the water filled the drift for 100 yards from the face, the road remaining in this condition until August, 1907, when it was unwatered by means of a compressed-air driven pump. No. 5 drift leaves the present engine plane at the point marked A on the plans (Plates IV. and V.) and for 480 yards was driven directly beneath it, the distance gradually increasing until the drift turned more to the north at B.

From the in-bye end the drift known as No. 6 or Taffy's Drift was started about eleven months before the explosion, and had been driven 438 yards, leaving 150 yards to be excavated to complete the road, and at the time of the explosion operations were being carried on from this end, which was the portion of the mine in which the explosion occurred.

The drift was being driven by a contractor, Mr. Rowland Williams, who found all labour and put in all timber and girders. He had eighteen drifters employed at the face and twelve hands, for taking away the stones, spread over three shifts, there being usually an interval between each shift of about an hour when no men were actually at the face, the outgoing shift passing the incoming one somewhere on the haulage road.

A hand-worked fan was placed in the drift and the men working it were understood to change at the fan itself, being paid overtime for so doing. They were employed and paid by the Colliery Company.

The Company's officials inspected the drift in compliance with the General and Special Rules, and a shot-firer for each shift was provided and paid for by the Company, who also provided the explosive and surface clay for stemming.

The "station" (General Rule 4) was the foot of the drift, a point known as "McAdam's turn."

The haulage road from which No. 6 Drift started is in stone (see plans and section). The rising gradient of the drift, 1 in 17, is nearly the same as that of the strata, and the drift did not cross-cut the "metals" to any great extent until it crossed at 200 yards a fault with an 18 fathom (36 yards) "upthrow" in the direction in which the drift was being driven. Before reaching the fault there was no coal in the drift, but after crossing it it was associated with two coal seams, an upper one 17 inches thick which was either in the roof or just above it, and a seam 7 inches thick 6 feet below the upper one, which was either removed in forming the drift or lay just below it.

There were workings in the Main Band above the whole length of Nos. 5 and 6 Drifts which workings had been abandoned 25 years ago. Above the inner portion of No. 6 Drift the pillars had been partially "robbed" or worked.

No. 6 Drift was completed to full size, viz., 13½ feet wide by 7½ feet high for about 200 yards from its commencement, the roof being supported by iron girders resting on props at each end and "lofted" above; beyond this completed length it was continued forward about 238 yards 10 feet wide and 5 feet high and timbered with legs and wooden crowns, the intention being to make it full size later and put in iron girders.

210 yards from the bottom of the drift was a 14 inch incline wheel, and up to this point two sets of rails were laid forming a self-acting incline, the loaded tubs of stone from the face always running on the south side. From the top of the incline to the face the tubs, ordinary coal tubs, were run by hand.

No. 6 Drift was ventilated at the time of the explosion by a range of iron air pipes which acted as the return air-way.

As shewn on the plan in Plate VI. there were two entrances to the drift separated by a small triangular pillar. One of these entrances, a curved road, called the "shunt," leading out-bye, was used for bringing out the loaded tubs of stones and a split of fresh air (from the current of 40,000 cubic feet per minute—measured as 63,384 cubic feet per minute on 7th November, 1907—) reaching the point, passed into it and up the drift returning by the iron pipes. To divert a portion of the air current into the drift a canvas sheet extending to within 1 to 2 feet of the floor was hung across the portion of the haulage road lying between the two entrances to the drift. The other entrance to the drift, the continuation of the drift itself, was closed by a brick wall 14 inches thick, and in it was a wooden door 5 feet by 4½ feet opening towards the face of the drift, and rails were laid through it along which the empty tubs were brought into the drift. At the left-hand upper corner of the wall two iron pipes 16 inches in diameter were inserted. One was not continued and its inner end was closed by canvas. The other pipe continued up the left side of the drift in 6 feet lengths fitting into each other with the joints caulked with putty and carried near the roof by wire attached to the girders and crowns. The pipes continued as 16 inch pipes for 239 yards and were then carried forward as 20 inch pipes for 136 yards to a hand fan 56 yards from the face, beyond which they were continued, also as 20 inch pipes, for 51 yards, at the time of the explosion extending to within 15 feet of the face of the drift.

The air ventilating the drift rejoined, on the in-bye side of the canvas sheet, the current it had left.

The hand fan which was 18 inches in diameter by 9 inches wide, geared 11 to 1, was placed in connection with the pipes so that it both exhausted air from the face and forced it to the other end of the range. A fan man was

only in attendance when men were engaged or about to be engaged at the face of the drift. When the fan was being worked the handle was revolved about 44 times per minute, the fan itself making 484 revolutions in the same time.

Evidence was given at the inquest that when the hand fan was working the ventilation was satisfactory, but that during the fan man's absence on Sundays, from about 4 a.m. to 10 p.m., gas accumulated next the face of the drift, and it was usual, before restarting work, or even attempting to reach the face of the drift, to work the fan for an hour or so. The same conditions prevailed on one occasion when the fan broke down and had to be sent to the surface for repairs. Evidence was also given that even when the face was clear of gas it was not unusual to find it next the roof at a considerable distance back, and this condition Mr. Atkinson observed after the explosion and when the pipes had been renewed.

Previously a small hand fan had been in use, and evidence was given at the inquest that prior to the installation of the larger hand fan men had been affected by the fumes from the explosive used, and in some cases had to be helped from the face. But it was stated that the explosive then in use was Geloxite, the fumes from which are more noxious than from Saxonite.

When there had been a cessation of work in the drift for several hours and no fan man in attendance it appears to have been assumed by the deputies that gas would be present at the face, and they did not attempt to make the statutory examination until the fan had been worked for some minutes and the gas cleared away. One of them stated at the inquest that before working the fan on a Sunday night after the usual stop he found on examining the air issuing from the pipe that it was charged with fire-damp.

It was stated at the inquest by one of the deputies that the practice of working the fan on Sunday nights before inspecting the face had gone on since 11th October.

Although the station fixed under General Rule 4 of the Coal Mines Regulation Act, 1887, was at the entrance to the drift, it appeared to be the custom for the deputy overman making the statutory examination of No. 6 Drift on the Sunday night, not only to take one or two men past the station with him to work the fan before he had made any examination, but also to allow the other workmen to come up the drift to a refuge hole where they were in the habit of leaving some of their clothes.

On September 24th, 1907, an inspection made by two representatives of the miners employed in the pit of the working places and roadways leading thereto of the Lowca District, No. 6 Drift, and Lowca return and reported as "all safe in good working order."

On Sunday, the 24th November, work ceased in the drift about 4 a.m. At 5 a.m. James Bigrigg, a deputy, was at the face, and he stated at the inquest that it was then clear of gas; he made a written report as to this inspection. About 10 p.m. Bigrigg came on duty again and reached the drift with a fan man about 11 p.m. Bigrigg went first and examined as far as the fan, and found it clear up to the fan; he then called the fan man forward and the fan was worked for $\frac{3}{4}$ hour. He then proceeded to the face and found it clear of gas, but he made no written report as to this inspection. The fan man was left in the drift, none of the other workmen having come down in the 10 p.m. shift. Bigrigg visited the face of the drift again at 5 a.m. on the 24th, and reported in writing that he found it clear of gas, and soon after the ordinary workmen started work at the face.

Bigrigg examined the face at 7 a.m. on the 25th, and reported it (in writing) as safe.

On the day of the explosion Bigrigg examined the drift from 6.15 a.m. to 7 a.m. and found it clear of gas. The fan man was at his post but no one was in the face at the time, but the result of a round of shots lay

ready for the next shift to clear away. He made a written report that No. 6 Drift was in safe working order.

The overman, Wilson Graham, was in the drift from 7.30 a.m. to 8 a.m. on the day of the explosion and found it in safe working order.

The under-manager, John Rothery, was at the face of the drift shortly after the overman left it and he found it in safe working order.

The miners employed in the Countess and Lowca districts were not allowed to ride on the endless rope road beyond McAdam's turn or the point where No. 6 Drift started, as the Manager did not consider it safe. They had made a demand to be allowed to ride further in-bye, and the Manager, accompanied by Mr. John Hanlon, local Miners' Agent for the Whitehaven Collieries, and Mr. Jas. Smallwood (local or check-inspector) on behalf of the William Pit miners, were down the pit together on the morning of the explosion respecting this question. The Manager promised that when the new road was completed an extension of the riding distances would be granted, and at about 9.40 a.m. they all visited the face of No. 6 Drift to see what progress was being made.

About 1.10 p.m., owing to the neglect of William Cowan (braker) to attach 6 tubs loaded with stone to the incline rope, they ran amain and collided with some loaded tubs standing near the bottom of the drift and caused a wreck. Cowan went to the face to report the mishap, and the Contractor's charge-man, Evan Evans, and all the face men except one went to the bottom of the drift to put matters right, one face man and the shot-firer remaining. When the tubs ran amain nine shots were just ready for firing.

Evan Evans who was present when the holes were drilled and charged, described them as follows:

Two opening or sumping holes started in the coal about the centre of the drift 2 feet apart, and were drilled 6 feet inclining downwards and leaving the coal seam and also converging so that the ends of the holes were 9 inches or 1 foot apart; in each of these holes six 4-oz. cartridges of Saxonite were placed. To the right of these holes three holes 5 to 5½ feet deep were also drilled, starting in the coal and in the same line as the course of the drift, and they were each charged with five 4-oz. cartridges; to the left of the opening holes were two holes of similar depth and charge to those on the right. At each top corner of the drift was a hole 4½ to 5 feet deep each charged with six or seven 4-oz. cartridges. He further stated that all the holes were stemmed for 9 inches to a foot with clay. An examination of the face after the explosion proved generally the accuracy of this account. Evans further stated that he was with the shot-firer when he fired the two sumping holes simultaneously, and that having left his watch at the face he returned with the shot-firer to get it after the sumping shots had gone off, and then saw Burns examine the face with his safety lamp and find it clean. Evans then left for the bottom of the drift, and when about half-way down heard the third hole fired. When close to the bottom of the drift the explosion occurred and he was knocked over and rolled up in some of the discarded canvas from the inner gallery. Evans said he saw no flame but felt a little heat. He was not burned.

The face men who had preceded Evans to the drift bottom were busy with the wreck and two of them were killed by violence; they were dead when found, and both appeared to have been killed by fracture of the skull; their bodies showed no signs of burning.

Going back to the time when Evan Evans had left the face and gone down the drift, William Cannon and John Kirkpatrick (two of the injured men) and Joseph Kennedy (who was killed), remained in a refuge hole 125 yards from the face, putting on their discarded upper garments before going down, and here some conversation took place as to which of them should remain at the fan until the next shift came on. While this discussion was proceeding, and after some of the shots had been fired, Burns came back from the face and said

the last shot fired had not "got" or done its work, and he made up another charge in their presence and then went back to the face to re-charge the hole and the others left to go to the bottom of the drift.

Thomas Moore, one of the injured men, stated that when he was at the bottom of the drift and after the third report of the shots was heard, he noticed the door in the empty road open about 18 inches or 2 feet, and it did not close again, and when he went to shut it he found it jammed and could not do so, and he further stated that the door was partly open for 5 or 10 minutes before the explosion occurred. William Cannon stated that he remembered seeing the door open but it closed again. Thomas Moore also said that between 9 and 10 a.m. on the day of the explosion, he saw Burns examine the drift for gas about 5 yards out-bye from the fan, and he found some and said, "there is "a bit there Tom." Moore said he had frequently seen gas back from the face when the face itself was clear.

The overman had passed the foot of No. 6 Drift about 1.25 p.m., and then saw there had been a runaway set, and heard the report of a shot in the drift. He went out-bye to a cabin at the turn known as the "friction gear," where there was a telephone to the surface and the two compressed-air engines, one for working the haulage in the Delaval District and the other for the Lowca District, and was there when the explosion occurred. He came out of the cabin, and the air which had been no doubt reversed or checked by the explosion had then resumed its normal course, and was laden with clouds of coal dust, which he thought were due to a fall on the haulage road further out-bye, and he sent a man in that direction to make an examination. Soon after a number of men came out-bye from the direction of the drift without lights. The overman then went at once to the drift.

A riding set was standing on the haulage road at the foot of the drift waiting for the morning shift of hewers and trailers, some of whom were near it at the moment of the explosion and others on their way to it, and a panic ensued amongst these men; most of them lost their lights, some ran in-bye, others out-bye. The dust raised on the haulage road, principally coal dust, nearly choked some of these persons.

Word was sent to the surface by telephone, and the Manager, who was in the office near the pit top, having just come out of the pit, being summoned, was soon on the spot.

The drift was found to be full of after-damp, the air tubes were nearly all blown down, the canvas sheet across the haulage road was not disturbed, but the door in the brick wall was blown away. No timber was displaced, and there were no falls of roof at the foot of the drift. One empty tub was broken by being forced against a stout prop under a running balk close to the haulage road, and the body of Fitzsimmons was found under it. A short distance up the drift was the empty set intended to be run "against" the runaway tubs; there was first a tram of rails connected to the rope and then three empty tubs, and the rails had been forced through both ends of the tub next the tram on which they were laid.

Kennedy was found mixed up with the tubs above the wooden door.

After removing the bodies of the two men who were killed at the bottom of the drift and seeing to and sending out on stretchers the injured persons (who were attended to by Dr. Harris, who came to the drift), a new sheet was hung across the haulage road and the wooden door replaced by canvas, and preparation made to get up the drift by replacing the air pipes so as to recover the bodies at the face.

Progress was rapid until smoke was encountered, which was driven back by falls of stone, heard taking place further in, and alarmed the explorers, who, fearing a considerable fire and a second explosion, made some preparations 60 yards up the drift to build a brick stopping. Eventually, however, at a distance of 140 yards up, a sleeper four inches thick was found to be on fire,

and near it was some burnt and smouldering brattice cloth, which had probably been first inflamed, and may have been blown out bye some distance while on fire. The fire was extinguished by the application of some water, and no further trouble was experienced from smoke.

Mr. Atkinson tested the air coming through the pipe end at the brick wall two or three times and observed no gas nor was the flame dimmed, but on going beyond the point to which pipes had been removed the air was bad and several of the workmen were affected.

Some yards up the drift a refuge hole was reached in which clothes, etc., were usually kept, and here a locked shot box containing some cartridges of Saxonite was found.

The bodies of the persons who had been near the face were reached about 7.20 p.m. on the day following the explosion. They lay together behind an empty tub which was derailed at the out-bye end. Burns the shot-firer lay between the tub and the right side of the road, his face was next the floor and was covered by his hands. Hanlon and Rowe were lying across the road against the inner end of the tub, and it was observed that Rowe's short trousers were round his ankles. These persons were severely burned, their hair was nearly all singed off and strips of skin were hanging loose. Unfortunately no doctor saw the bodies, but from what Mr. Atkinson and others observed there was a pinkness suggestive of carbonic-oxide poisoning, and the face of Rowe had a singularly placid expression which is characteristic of such cases. The death of a canary in a situation where the lamp flame was hardly affected, and the appearance of the bodies of the victims of the explosion who were next the face, pointed to the presence of carbonic-oxide in the after-damp. When an inflammable or explosive mixture of fire-damp and air in which there is an excess of fire-damp, that is more than 10 per cent. by volume of the mixture, is ignited, it is stated that carbonic-oxide as well as carbonic-acid gas is one of the resultant gases, and this condition (an excess of fire-damp) must apparently have prevailed over some portions of the drift.

An extinguished safety lamp (No. 753) lay on its side near the bodies and a locked circular shot box containing three cartridges of Saxonite was under Hanlon's body.

Two yards nearer the face was the battery lying on its side with the cable uncoupled but the detachable handle still on. An extinguished safety lamp (No. 829) lay on its side within a foot of the battery. The cable extended from the battery to the face and was permanently fixed to the balks supporting the roof.

Eight yards from the empty tub was a loaded tub standing on the rails. On the end of the empty tub slight spots of what appeared to be coke were observed, and the general colouring for 100 yards back from the face was perceptibly blacker than further out.

After the last three bodies had been recovered operations were continued until the air pipes were extended to the face, which was reached at 5 a.m. on the 28th, and later in the day Mr. Abbott made an examination of it, and he and Mr. Atkinson made a further examination on December 2nd, and January 6th. As already stated the account given by Evan Evans was substantially correct, and it was observed that no debris had been removed from the shots that had been fired, and no tools were near the face. It was found that the two opening shots had been fired and were successful in dislodging the coal and some of the fire clay. The left side of the left sumping hole could be traced for 3 feet 6 inches; the right side sumping hole could not be traced; the right side of the next hole to the right could be traced for 4 feet and this shot had been successful. The second hole to the right of the sumping holes had been fired and was blown out, no mineral having been dislodged. This hole starting about the middle of the coal seam dipped slightly and contained water. A stick could be introduced into it for a distance of 3 feet 1 inch. There were no wires attached to the cable which extended over a crown to within a few feet of the mouth of the

hole. At 16 yards and 18 yards from the face in the line of the blown out shot detonator wires were found stuck into timber facing the hole, and may have been wires from the shots fired.

A rough approximation was made by extending the line of the hole out-bye by a string as to how far from the face the effect of the dipping of the hole, in conjunction with the rise of the drift, would cause the axis of the hole to strike the roof, and it was found to be about 14 yards, the line grazing a prop at 11 yards.

What material had been used as stemming in the blown out hole could not be determined. A stick was inserted into the hole several times and examined, and it was thought that there was some appearance of clay but this was doubtful. The mouth of the blown out hole was not fractured and Mr. Williams, the contractor, expressed the opinion at the inquest that judging from this the hole had probably not been stemmed at all.

The unfired holes were examined. Of the top holes both were stemmed with clay, one to within 1 foot and the other to within 1 foot 6 inches of the mouth.

Of the unfired holes in the coal seam that to the extreme left was stemmed with clay to within a short distance of the mouth. The hole next it was stemmed or contained small coal and coal dust, and an inch or two was raked out and produced at the inquest. It was then suggested that the effect of the explosion might have blown coal debris into the hole, but this is not probable.

The hole to the extreme right was stemmed to within 2 feet 4 inches of its mouth with clay.

A large supply of surface clay was found at the "dilley" top and near it was a smaller supply.

The remembrance of the various witnesses as to the number of shots they heard fired was somewhat conflicting, but taking their story in conjunction with what was observed at the face of the drift after the explosion it is probable that the two opening or sumping holes were fired simultaneously and did their work and would be heard as one report, then the first hole to the right was fired and did its work, then the second hole to the right was fired and blew out and this would be when the door at the drift bottom opened and was said to have jammed; this hole was then recharged and blew out a second time and was the cause of the ignition of the fire-damp.

The mechanical effects of the explosion were not considerable and were least near the face and at the bottom of the drift.

The flame accompanying the explosion probably did not reach as far down the drift as the burning sleeper and smouldering brattice cloth; as already suggested the latter was probably blown out-bye after having been ignited. Some of the survivors from the bottom of the drift said they were burned slightly while others said they were not, and the bodies of the two men killed showed no sign of burning.

There was practically no coal dust in the drift; the greater part of its length was dry, dampness appearing as the face was reached. Where it was dry there was a considerable quantity of fine grey stone dust on the floor mixed with coarser particles, and on the timber there was a coating of this dust, mostly on the out-bye-side and no doubt deposited at the time of the explosion.

The atmospheric conditions were not unfavourable to the appearance of fire-damp.

Observations taken in the pit in the cabin at the "friction-gear" on a mercurial barometer on the day of the explosion were as follows:—

At 6 a.m.—Barometer 29.75 inches.
Temperature 64½° F.

About 2 p.m.—Barometer 29.00 inches.
Temperature 64½° F.

Although the jury did not so find it was not disputed that the flame originating the explosion arose from the firing of the blown out shot in the coal seam, and as already indicated there may be some suspicion as to the nature of the stemming or whether it was stemmed at all.

The cause of the explosion was undoubtedly fire-damp, which must have been present in considerable quantity, and it is difficult to conceive how it had escaped the notice of the persons in the drift. If fire-damp had issued in considerable volume from the face either due to the boring of the holes or to the effect of the shots fired, as was suggested by some of the witnesses at the inquest, it could hardly have escaped the notice of the men working there or of Burns the shot-firer, and the evidence of Evans proved that the face was clean after the sumping holes were fired.

Again if the gas issued from the face it might have been expected that the explosion would have been more violent in the air pipes down which it would be carried by the air current, and that some at least of the pipes would have been burst open rather than flattened. Had there been an explosive mixture both outside and inside the pipes it is probable that they would have been flattened, as the resistance of such pipes to internal disruption is much greater than to external flattening.

At the point where the drift caused the fault some difficulty had been experienced with the roof, and on one occasion a considerable fall of stone had taken place here for which, it was stated by the Contractor at the inquest, from 60 to 100 tubs of stones had been filled away and lofting put in, and that some time after another fall took place on to the lofting; beyond the fault where the 17 inch coal seam formed the roof of the drift open fissures were observed in it, and Mr. Atkinson found gas lodging here after the explosion when none could be observed in the lamp flame at the face.

The question of the fire-damp exuding through fissures possibly extending to the old workings in the Main Band above was considered, but it was stated at the inquest that the creep had probably closed these workings, that in any case there was direct access from them to the return air ways, and that if fissures existed the flow would naturally be from the drift up them and then into the return air way rather than that gas should come down them into the drift. It was further stated that more black-damp than fire-damp had been observed in the vicinity of the old workings.

The runaway tubs had not damaged the air pipes or other arrangements connected with the ventilation, and they had not blocked the entrance to the drift, but it is possible that the rapid motion of the tubs may have had some effect in drawing gas into the drift especially in conjunction with the falling barometer.

The door at the bottom of the drift as already stated opened with the concussion of one of the shots, and according to one witness stood partly open for from 5 to 10 minutes. This would reduce the air coming down the tubes considerably if the fan was also standing, but not probably to any great amount if the fan was working.

The drift was being driven in virgin ground charged with fire damp, and although a sudden fall in the barometer has more effect on the issue of gas from unventilated and abandoned workings or goaves than from the solid strata, yet it has some effect in the latter case, and where the ventilation is feeble the effect is more pronounced. It was clear that when the fan was not being worked the ventilation was not sufficient to clear away the normal issue of gas, and when the fan was being worked, which would always be, to some extent, an intermittent operation, the margin was not sufficient to meet the issue of an extra quantity of gas which in the present case was probably largely due to the fall of the barometer, assisted by the effect of the runaway set of tubs, by the effect of the blown out shots and by the accompanying opening of the door.

It seems probable that from the combined effect of these causes a quantity of fire damp was present in the drift, principally near the roof, and gradually moving forward was ignited by flame from the last shot and had not up to that time shown itself at the face, although it is only reasonable to assume that it must have been present over Burns's head when he turned on the current the last time at a distance of 56 yards from the face. Whether Burns knew (as it was proved he did know earlier in the shift) that gas lay next the roof near the battery must remain a mystery, but the suspicion must remain that he was aware of the presence of the gas and relied on the presumed safety of the Permitted Explosive.

It is usual to ventilate stone drifts by a split of air which, after leaving the drifts, passes into the return air-way, so the mode of ventilating in this case was unusual. The reason for its adoption was the fact that access to a return air-way was not available, as was the case with No. 5 Drift, where pipes were used to convey fresh air to the face, which then passed up the drift and direct into the return air way, and here it was stated no difficulty had been experienced as regards gas, which, however, would be largely due to the fact that the drift dipped instead of rising to the face.

As already stated, the flame did not reach the engine-plane, which contained coal dust (due to the carriage of the coal against the air current), in considerable quantity both on the floor and as fine dust on the upper surfaces of the road and on the timber and girders, the flanges of the latter affording a convenient place for its deposition. This dust was raised in dense clouds by the explosion, and as already stated caused much inconvenience to the persons exposed to it, and had the flame reached the haulage road the loss of life would have been very great, as probably all the morning shift, amounting to 180 persons in-bye of the "friction-gear," would have lost their lives.

The following breaches of the Coal Mines Regulation Acts, 1887 and 1896, appear to have been committed:—

1. Breach of General Rule 1, Section 49, of the Coal Mines Regulation Act, 1887, in respect that ventilation was not constantly produced in No. 6 Drift so as to dilute and render harmless noxious gases.

2. Breach of General Rule 4, Section 49, of the Coal Mines Regulation Act, 1887, in respect (*a*) that on some occasions the competent person (the deputy) did not inspect that part of the mine situated beyond the station at the entrance to No. 6 Drift and make a true report as to its state before allowing workmen to pass such station; (*b*) that workmen were in the habit of passing such station before the competent person had made the prescribed examination. These breaches refer to the practice after the interval on Sunday.

3. Breach of General Rule 12 (d), Section 49, of the Coal Mines Regulation Act, 1887, as amended by Section 5 (3) of the Coal Mines Regulation Act, 1896, in respect that the provision that "only clay or other non-inflammable substances "shall be used for stemming" was not observed as regards one of the holes.

4. Breach of General Rule 12 (g), Section 49, of the Coal Mines Regulation Act, 1887, in respect that shots were fired in No. 6 Drift while inflammable gas had been reported to be present in the ventilating district in which the shots were fired at the last four inspections under General Rule 4, and such gas was not reported to be cleared away, and the explosive used was not of such a nature that it could not inflame gas.

The breach of the rule on the part of the deputy in allowing workmen to pass the station on the Sunday nights before they had made the statutory examination of the drift has some justification as regards the men required to assist in working the fan. It was not the fault of the deputy that gas was allowed to accumulate, and they took advantage of the only means of removing it by working the fan.

Their wisest course would have been to have taken advantage of General Rule 7 (withdrawal of workmen in case of danger) which, although not strictly applicable to the case, as there were no men to withdraw, yet prescribes a course that would have relieved them of any responsibility; they should first have examined the drift and made a true report as to its state, then allowed the persons necessary to work the fan to come past the station, and when the drift was clear of gas have reported again to that effect and allowed the remainder of the workmen to pass the station.

In any case they were clearly not justified in allowing the body of the workmen to pass the station until the drift had been found by them to be in a safe condition.

I have the honour to be,

Sir,

Your obedient Servant,

R. A. S. REDMAYNE.

PLATE I

BENWELL COLLIERY EXPLOSION

19TH MARCH, 1907

PLAN SHEWING POSITION OF AREA AFFECTED BY EXPLOSION

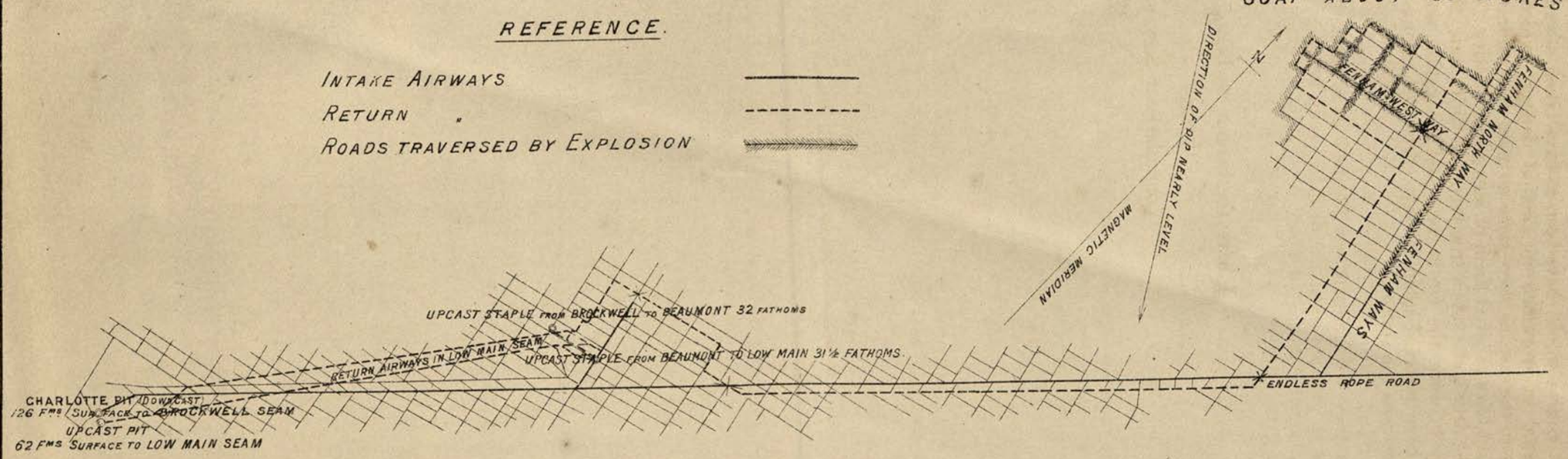
SCALE 7·9 CHAINS TO AN INCH

REFERENCE.

INTAKE AIRWAYS ——————

RETURN " ----------

ROADS TRAVERSED BY EXPLOSION ≡≡≡≡≡


GOAF ABOUT 60 ACRES
DIRECTION OF A NEARLY LEVEL
MAGNETIC MERIDIAN
N
FENHAM WEST WAY
FENHAM NORTH WAY
FENHAM WAYS
UPCAST STAPLE FROM BROCKWELL TO BEAUMONT 32 FATHOMS
RETURN AIRWAYS IN LOW MAIN SEAM
UPCAST STAPLE FROM BEAUMONT TO LOW MAIN 31½ FATHOMS
ENDLESS ROPE ROAD
CHARLOTTE PIT (DOWNCAST)
126 Fms SURFACE TO BROCKWELL SEAM
UPCAST PIT
62 Fms SURFACE TO LOW MAIN SEAM

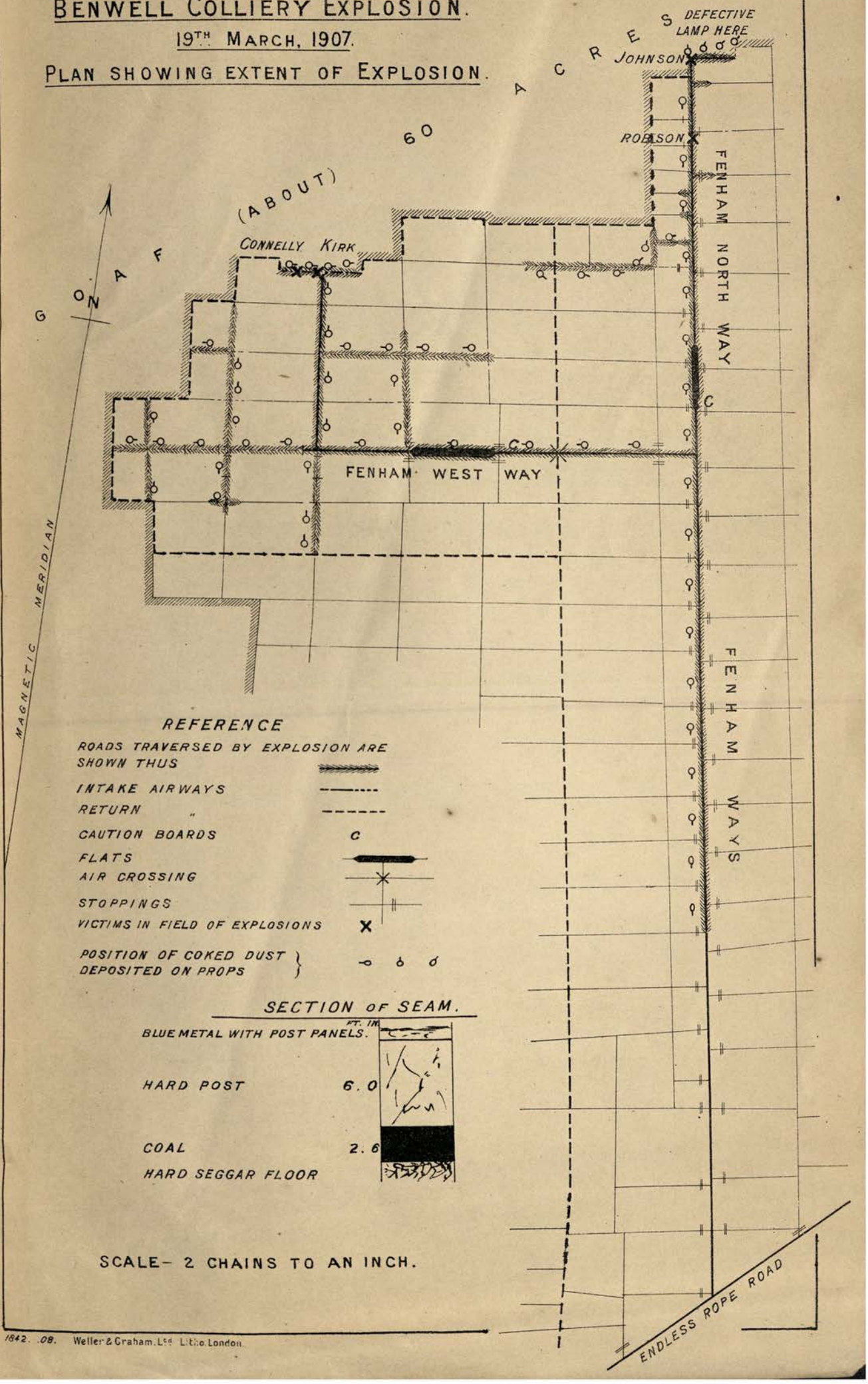
Weller & Graham, Ltd Litho. London.

PLATE II

BENWELL COLLIERY EXPLOSION.

19TH MARCH, 1907.

PLAN SHOWING EXTENT OF EXPLOSION.



REFERENCE

ROADS TRAVERSED BY EXPLOSION ARE SHOWN THUS

INTAKE AIRWAYS

RETURN "

CAUTION BOARDS C

FLATS

AIR CROSSING

STOPPINGS

VICTIMS IN FIELD OF EXPLOSIONS X

POSITION OF COKED DUST DEPOSITED ON PROPS

SECTION OF SEAM.

	FT. IN
BLUE METAL WITH POST PANELS.	
HARD POST	6.0
COAL	2.6
HARD SEGGAR FLOOR	

SCALE- 2 CHAINS TO AN INCH.

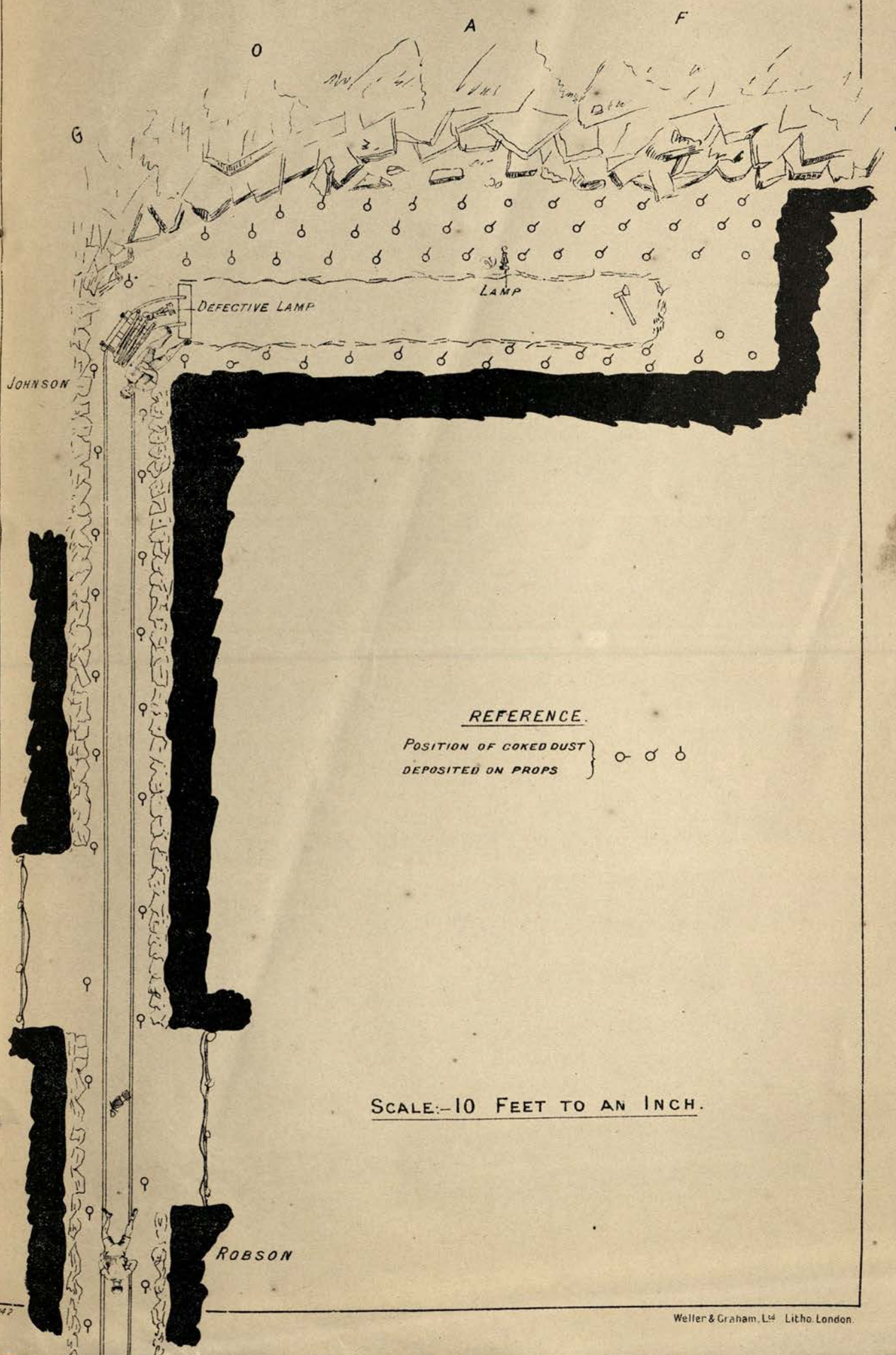
1842. .08. Weller & Graham, Ltd. Litho. London.

PLATE III

BENWELL COLLIERY EXPLOSION.

19TH MARCH 1907.

ENLARGED PLAN OF POINT OF ORIGIN



REFERENCE.

POSITION OF COKED DUST DEPOSITED ON PROPS

SCALE:—10 FEET TO AN INCH.

Weller & Graham, Ltd Litho. London.

PLATE IV.

WHITEHAVEN COLLIERIES.
WILLIAM PIT

PLAN SHEWING MAIN ROADS, FAULTS, AND POSITION OF Nº 6 DRIFT.

SCALE 1/20,000 OR 3·168 INCHES TO ONE MILE

REFERENCE

INTAKE AIRWAYS ..... SHEWN THUS

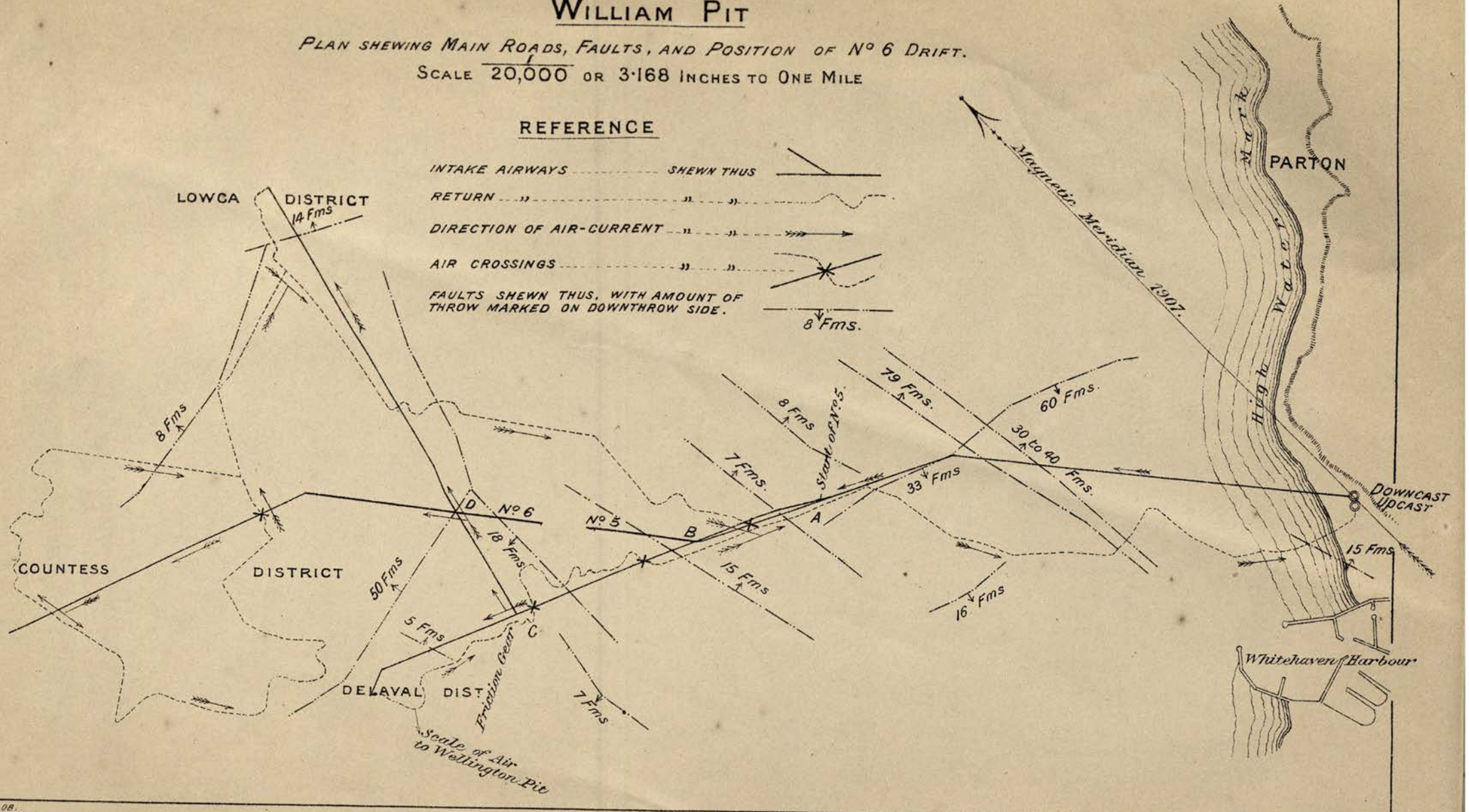
RETURN ... " ..... " ... "

DIRECTION OF AIR-CURRENT ... " ... " ...

AIR CROSSINGS ..... " ... "

FAULTS SHEWN THUS, WITH AMOUNT OF THROW MARKED ON DOWNTHROW SIDE.

8 Fms.

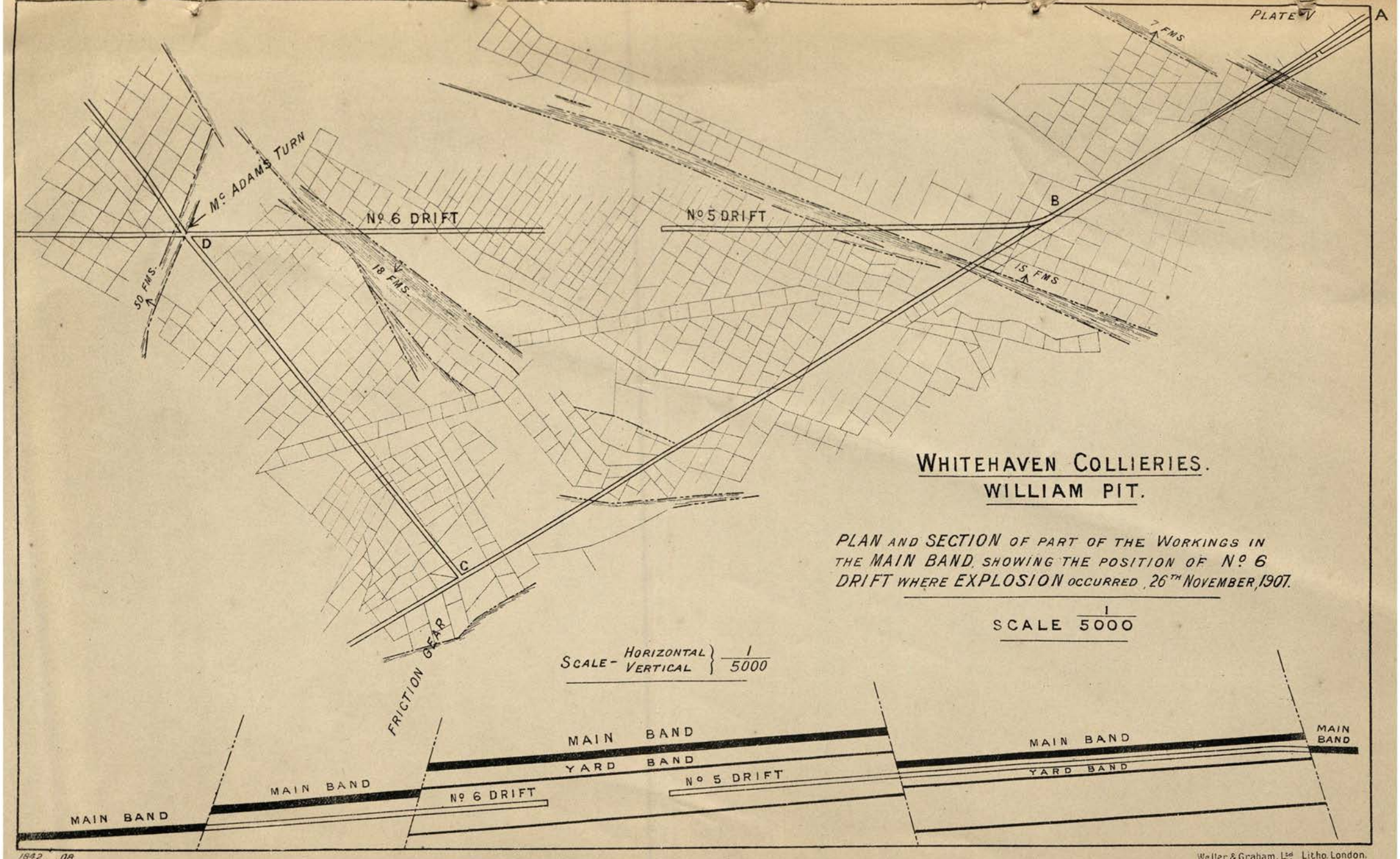


1842. 3. 08.

Weller & Graham, Ltd Litho. London.

PLATE V

A



WHITEHAVEN COLLIERIES.
WILLIAM PIT.

PLAN AND SECTION OF PART OF THE WORKINGS IN THE MAIN BAND, SHOWING THE POSITION OF No 6 DRIFT WHERE EXPLOSION occurred 26TH NOVEMBER, 1907.

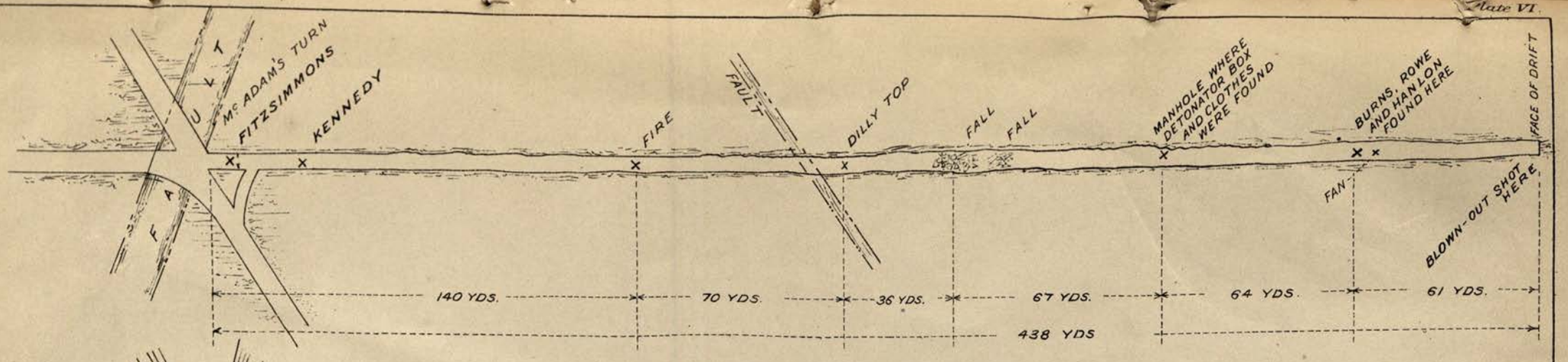
SCALE $\frac{1}{5000}$

Scale - Horizontal } $\frac{1}{5000}$
Vertical }

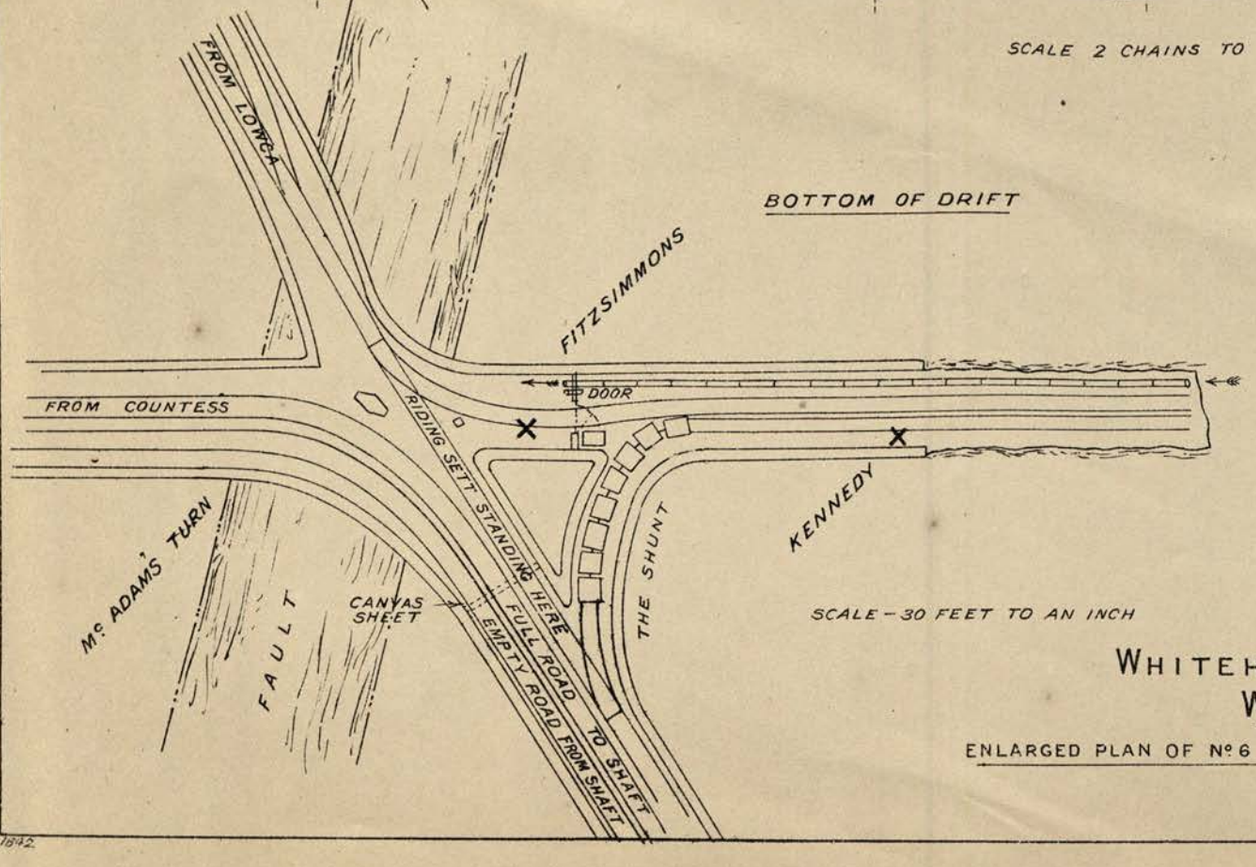
1842. .08.

Weller & Graham, Ltd Litho. London.

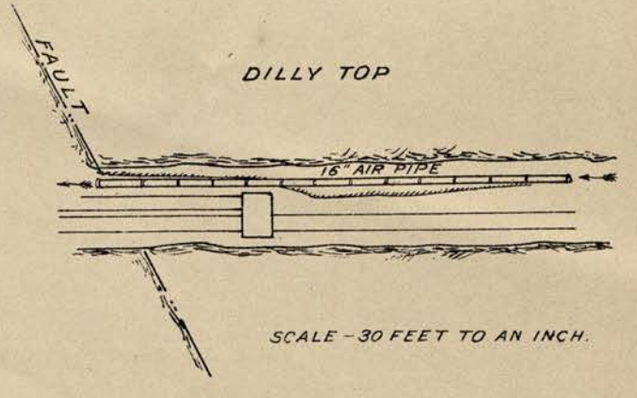
Plate VI.



SCALE 2 CHAINS TO AN INCH.



SCALE – 30 FEET TO AN INCH



SCALE – 30 FEET TO AN INCH.

WHITEHAVEN COLLIERIES
WILLIAM PIT.

ENLARGED PLAN OF No 6 DRIFT EMBRACING AREA OF EXPLOSION.

1842.

Weller & Graham, Ltd Litho. London.

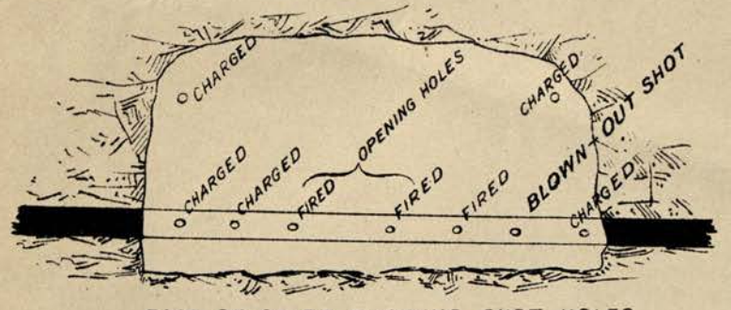
Digitized with financial assistance from

Shri Brihad Bhartiya Samaj

on 24 February, 2020

FACE OF DRIFT

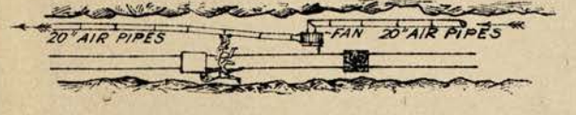
SCALE - 30 FEET TO AN INCH



FACE OF DRIFT SHOWING SHOT HOLES

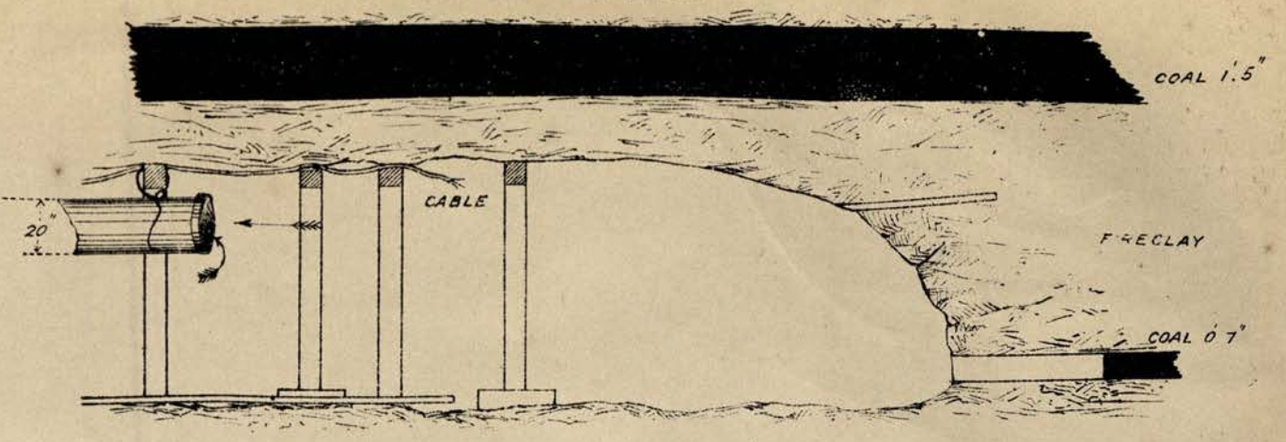
SCALE - 4 FEET TO AN INCH

FAN

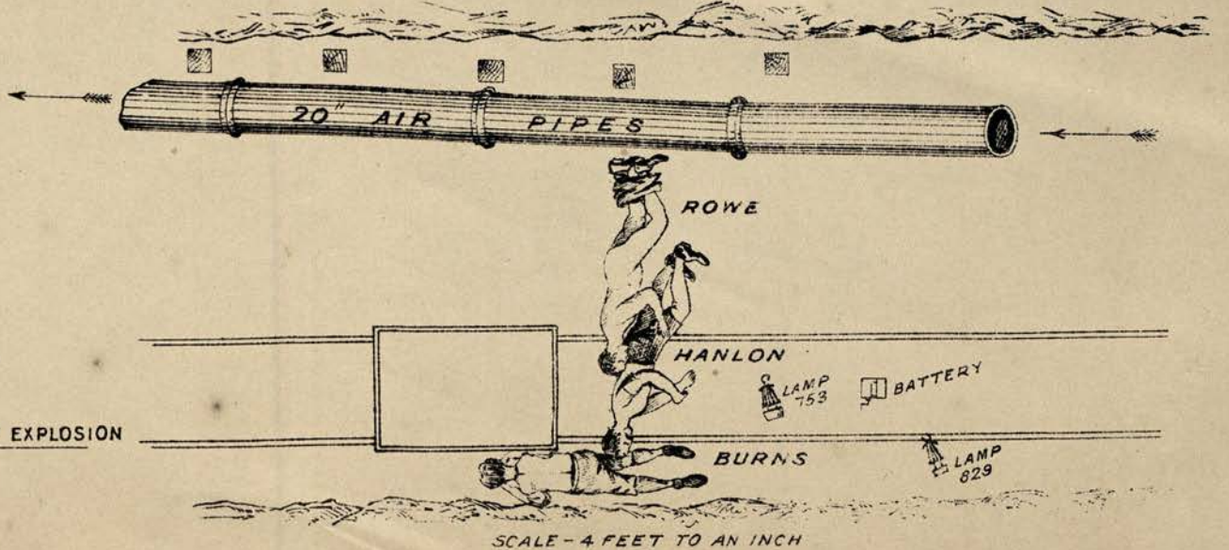


SCALE - 30 FEET TO AN INCH.

FACE OF DRIFT



SCALE - 4 FEET TO AN INCH



SCALE - 4 FEET TO AN INCH

WHITEHAVEN COLLIERIES.
WILLIAM PIT

ENLARGED PLAN OF Nº6 DRIFT EMBRACING AREA OF EXPLOSION

Weller & Crane ... Ino London